USDA NRCS
Natural Resources Conservation Service
Conservation Across America

Estimation of N available from natural sources:

What are the natural sources of N available to the crop?

- Deposition from rainfall.
- Soil organic matter mineralization.
- Legumes, if present.
- Previous year's residue.
- Non-symbiotic soil microbes and algae.

Deposition from rainfall varies, but it is estimated at 4 - 8 lbs/ac for most of the Bryan Zone (see nonpoint and point sources of N, USGS handout).

Soil organic matter mineralization and the amount accumulated in soil varies primarily due to cover type, soil texture, management, and climate (see generalized map showing native O.M. amounts, and Table below adapted from Laws and Evan 1949).

Comparison of Blackland O.M. Based on Management

Site	% O.M. Rangeland 0-6"	% O.M. Cropland 0-6"
1A	**5.2**	**2.8**
1B	**5.6**	**2.9**
2	**2.9**	**2.8**

Explanation of results:

Site 1A Rangeland - Cut once a year for native hay, climax community largely maintained.

Site 1A Cropland - Farmed continuously for 40 - 50 years mostly cotton with occasional small grains.

Site 1B Rangeland - Same as 1A

Site 1B Cropland - Farmed continuously for 90 years continuous cotton.

Site 2 Rangeland - Over grazed, climax community largely replaced by common bermudagrass and weeds.

Site 2 Cropland - Farmed continuously for 25 - 30 years to row crops.

Observations and Conclusions:

- It took less than 25 years to reduce O.M. by 50%.
- The O.M. rate stabilized at about 2.8% in all situations on Blackland clay soils.
- Over grazing can be just as bad for soil quality as cropping to cotton.

How much N is made available annually from O.M. mineralization?

According to Texas Ag. Extension “rule of thumb”, 20 - 30 lbs/ac are made available for each percent of O.M, so if your soil contains 1.5% O.M. you could estimate N mineralized at 30 - 45 lbs/ac. (Some other sources suggest 40 - 70 lbs/ac per percent O.M.)

NRCS Nutrient Mgt. Std. Gives a range of 15 - 30 lbs/ac (depending on rainfall) from “other” sources which includes atmospheric deposition. This may be a little low.

Amount of N available from annual legumes:

According to Dr. Gerald Evers at Overton Experiment Station, the amount of N available to the next year’s crop is approximately equivalent to 3% of the legume’s annual dry matter production (Air dry wt. - 16%).

For example, if you estimated (or clipped) the total annual production of clover at 2000 lbs/ac, the estimated amount of N available to the next crop would be (2000 - 16%) x 5% or about 84 lbs/ac.

Amount of N from residue, microbes, and algae:

A certain amount of N will be released from the previous year’s residue, depending on amount and quality of residue it might be 5 - 10 lbs/ac in a pasture situation.

Non-symbiotic of free living nitrogen fixing bacteria occur in most soils. The amount is dependent upon the condition and competition from other microbes. Algae and other soil flora can also be a source of N. I have seen ranges of 20 - 50 lbs/ac of N production from these critters, but I usually don’t consider them a major source in most pastures.

Effect of N on Yield, Protein Content and N Use Efficiency

N (lbs/ac) Applied	Tons Harvested per Acre[1/]	Crude Protein%[2/]	Pounds N Removed per Acre	Estimated % Available N Used[3/]
0	**0.8**	**6.9**	**14.8**	**59.2**
50	**2.1**	**7.3**	**41.2**	**54.9**
100	**3.2**	**8.2**	**70.5**	**56.4**
200	**4.7**	**8.8**	**111.2**	**49.4**
400	**8.4**	**13.1**	**295.8**	**69.6**

Adapted from Burton (1954) N applied in single application in March all plots had adequate P and K.
1/ - Hay yields shown are at 16% moisture.
2/ - Percent expressed on dry weight basis.
3/ - Assumes 25 lbs/ac N available from natural sources.

Calculations:

Since protein is based on dry wt., the moisture must be subtracted from the hay yield before making further calculations. (2.1 tons - 16% = 1.764 tons dry x 2000 = 3528 pounds dry)

Then multiply by % crude protein (3528 pounds x 7.3% = 257.54 lbs crude protein)

Divide pounds of protein by 6.25 to get pounds of N in a ton of hay (257.54 lbs CP ÷ 6.25 = 41.2 lbs N per ton of hay).

NOTE: Crude Protein (CP) is about 16% N.

Now, what percent of the available N was taken up by the hay fertilized at 50 lbs/ac?

If we assume that 25 lbs of N is available per acre with no N application, the 50 lbs/ac application resulted in 75 lbs of N available per acre. (41.2 lbs/ac N in hay ÷ 75 lbs/ac available x 100 = 54.9% of available N taken up by hay).

Effect of Clipping Frequency on Yield and Quality of Bermudagrass Hay

Clipping Interval (wks)	Hay Yield Tons/ac[1/]	Crude Protein %[2/]	Pounds N Removed per Acre	Estimated % Available N Used[3/]	
1	**6.2**	**21.4**	**356.6**	**57.0**	
2	**7.8**	**20.8**	**436.1**	**69.8**	
3	**8.6**	**18.8**	**434.6**	**69.5**	
4	**9.7**	**17.0**	**443.3**	**70.1**	
6	**12.5**	**13.8**	**463.7**	**74.2**	
8	**12.5**	**12.2**	**409.9**	**65.6**	

Adapted from Prine and Burton (1956); Knox et al. (1958).
1/ - Hay yields shown are at 16% moisture.
2/ - Percent expressed on dry weight basis.
3/ - Assumes 25 lbs/ac N available from natural sources.
All plots received 600 lbs/ac N in spring; all plots had adequate P and K.